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WEEKLY EVENING MEETING,

Friday, February 6.

THE DUKE OF NORTHUMBERLAND, F.R.S., President,
in the Chair.

JOHN SCOTT RUSSELL, Esq., F.R.S.

On Wave-line Ships and Yachts.

THE subject placed on the list for consideration this evening has been suggested by the assertion, which within a year or two has been so often repeated, that our Transatlantic brethren are building better ships than ourselves; that in short Brother Jonathan is going ahead, while John Bull is comfortably dozing in his arm-chair; and that if he do not awake speedily, and take a sound survey of his true position, he may soon find himself hopelessly astern.

Two questions of a practical nature arise out of this alarming assertion;—1st, whether the Americans are really in any respect superior to the English in nautical matters; 2nd, whether in order to equal them we are to be condemned to descend into mere imitators, or whether we have independent ground from which we can start with certainty and originality on a new career of improvement in Naval Architecture?

In the outset I beg permission to say, that I am not one of those who shut their ears to the praises of our young and enterprising brethren over the water, or view their rapid advancement with jealousy. It has been my good fortune to know some distinguished highly educated American gentlemen, philosophers, politicians, engineers, and ship-builders; men whom I should be proud to call Englishmen. I have for the last fifteen years been kept by them well informed of the progress of Steam Navigation in that country; and I beg therefore to express my perfect belief in the accounts we have heard of their wonderful achievements in rapid River Steam Navigation. I am satisfied, as a matter of fact, that 21, 22, 23 miles an hour have been performed, not once, but *often*, by their River Steam-boats. To that we cannot in this country offer any parallel.

The next point in which they also had beaten us was in the construction of the beautiful Packet-ships, which carried on the passenger trade between Liverpool and America before the era of Ocean Steamers. These were the finest ships in the world, and they were mainly owned and sailed by Americans.

The next point at which we have come into competition with the

Americans has been lately in Ocean Steam Navigation. Three years ago they began : they were immeasurably behind us at starting ; they are already nearly equal to us ; their Transatlantic Steam-packets equal ours in size, power, and speed. In regularity they are still inferior. If they continue to advance at their present rate of improvement, they will very soon outstrip us.

Next I come to the trade which has long been peculiarly our own, the China trade. The Clipper ships they have recently sent home to this country have astonished the fine ships of our own Smiths and Greens. Our best ship-owners are now trembling for their trade and reputation.

Finally, it is true that the Americans have sent over to England a yacht called the *America*, which has found on this side of the Atlantic no match ; and we only escaped the disgrace of her having returned to America, without any of us having had the courage to accept her defiance, through the chivalry of one gentleman, who accepted the challenge with a yacht of half the size, on this principle, so worthy of John Bull, " that the Yankee, although he might say that he had beaten us, should not be able to say that we had all run away."

Such then at present is our actual position in the matter of Ships, Yachts, and Steam Navigation, a position highly creditable to the Americans, and which deserves our own very serious consideration.

I propose to-night to examine a little into the physical causes of the naval success of the Americans ; but before doing so, permit me to point out a moral one, which later in the evening you will also find to lie at the bottom of the physical causes. It is this ; — John Bull has a prejudice against novelty ; Brother Jonathan has a prejudice equally strong in favour of it. We adhere to tradition, in trade, manners, customs, professions, humours ; Jonathan despises it. I don't say he is right and we are wrong ; but this difference becomes very important, when a race of competition is to be run.

These preliminary remarks find immediate application in the causes which have led to our loss of character on the sea. The Americans, constantly on the alert, have carried out and applied every new discovery to the advancement of navigation ; while with the English, naval construction and seamanship is exactly that branch of practice in which science has not only been disregarded, but is altogether despised and set aside. The American ships shew what can be done by modern science unflinchingly put in practice ; the English shew what can be done in spite of science and in defiance of its principles.

The immediate cause of the defects of English ships, and the most glaring instance of the outrage of all true principle in the practice of navigation, was to be found for many years in the English Tonnage law. It was simply an Act of Parliament for the effectual and compulsory construction of bad ships. Under that law, the present fleet of merchant ships and of ship-builders has chiefly grown up, and though at length and only recently abrogated, its influence is still left behind and is widely prevalent. This Act

of Parliament compelled the construction of bad ships under heavy penalties. The old Tonnage law, according to which ships were built and registered and taxed and bought and sold, virtually said to the builder and owner, "Thou shalt not build a ship of the necessary beam to carry sail; Thou shalt not give her the depth and height necessary to security and sea-worthiness; Thou shalt not build her of any suitable shape for speed, under penalty of 20, 30, and 40 per cent of fine for every ton of freight so carried in such ship." In short the law offered a premium on a ship, the amount of which was in the proportion of her being wall-sided, top-heavy, crank, unweatherly, and slow: while it inflicted a penalty in the shape of port charges and all pilot, harbour dues, lights, &c. in proportion to her fitness and reputation as a sea-worthy, fast, and wholesome ship. To cheat the law, that is to build a tolerable ship in spite of it, was the highest achievement left to an English builder, and formed his continual occupation.

The manner in which the English system was opposed to the good qualities of a ship, especially speed, is only to be understood by an analysis of these qualities. The two examples selected for illustration of the qualities of sailing vessels, were — the yacht *America*, built without restriction of any kind, and the yacht *Titania* built under the restrictions of the law of measurement of Tonnage, which is still retained in all its deformity by the English Yacht squadron.

It was shewn how the element of "stand-up-ativeness" is dependent on the beam of the vessel at the water-line; how the power of carrying sail depends on this element, and how this element is prohibited to the utmost by the Yacht Club's law of Tonnage. Another element of the vessel, the area of her vertical longitudinal section immersed in the water, is by another portion of the law compelled to be reduced in an injurious degree. — It was next shewn that in the other elements of the form of the two vessels they were nearly identical; and that they were *both* under water constructed on the *Wave Principle* in its most perfect form. But for the existence therefore of these antiquated laws our yacht-builders and our ship-builders would have had nothing to fear from competition. Happily the mercantile Tonnage law had been altered and the new law was all that could be desired; and in consequence a new race of fast ships were rapidly springing up. The old Yacht law unhappily remained. It is peculiarly unfortunate, however, that the evils bad laws have done, do not lie with them; and in this instance it has been found that when men have been trained for generations under a bad system, their prejudices remain too deep-rooted to achieve a sudden change of existence, and keep them in the deep and worn ruts of routine, by habits of thought and opinion almost inveterate. It is, however, to be hoped, that in the next ten years the English will escape from their prejudices, and that the rising generation will supply no unworthy competitors to their young and emancipated brethren on the other side of the water.

It appeared from the comparison which was instituted between the construction of American and English vessels, that the American

ship-builders have gained over the English chiefly by the ready abandonment of old systems of routine and the adoption of the true principles of science and the most modern discoveries. They have changed their fashions of steamers and ships to meet new circumstances as they arose. For River Steamers they at once abandoned all the known sea-going forms, and created an absolutely new form and general arrangement both of ship and machinery. We, on the other hand, subject to the prejudices of a class, invariably attempted to make a river steamer as nearly as possible to resemble a sea-going ship propelled by sails. We were even for a long time so much ashamed of our paddle-wheels, that we adopted all sorts of inconvenient forms and inapt artifices to conceal them, as if it were a high achievement to make a steam-vessel be mistaken for a sailing vessel.

The fine sharp bows which the Wave Principle has brought to our knowledge have been adopted in this country with the greatest reluctance, and those who adopt them are often unwilling to allow that they are wave-bows, and would fain assert that "they always built them so," were it not that ships' lines are able to speak for themselves. The Americans however adopted the wave-bow without reluctance, and avowed it with pleasure the moment they found it give them economy and speed. In like manner, the Americans having found the wave-bow or hollow bow good for steamers, were quite ready to believe that it might be equally good for sailing vessels. We on the other hand have kept on asserting that though we could not deny its efficacy for steamers it would never do for vessels that were meant to carry sail. The Americans on the contrary immediately tried it on their pilot-boats, and finding it succeed there, avowed at once, in their latest treatise on Naval Architecture, the complete success of the principle; not even disclaiming its British origin. To prove to ourselves our insensibility to its advantages — they built the America, carried out the wave principle to the utmost, and despising the prejudices and antiquated regulations of our Clubs, came over and beat us.

The diagrams and models which were exhibited shewed the water-lines of the America to coincide precisely with the theoretical wave line.

In one other point the Americans had shewn their implicit faith in science, and their disregard of prejudice. Theory says, and has always said, "Sails should sit flat as boards." We have said, "They should be cut so as to hang in graceful waves." It has always been so; we have always done it. The Americans believed in principle, and with flat sails went one point nearer to the wind, leaving prejudice and picturesque sails far to leeward.

In other points the Americans beat us by the use of science. They use all the refinements of science in their rigging and tackle; they, it is true, have to employ better educated and more intelligent men — they *do so*; and by employing a smaller number of hands, beat us in efficiency as well as in economy.

Faith in the value of Science, for the uses of practice, and a determination to carry it straight out with a total disregard of previous